



## TABLE OF CONTENTS

APPROVAL PAGE .....	iii
PLAGIARISM FREE STATEMENT .....	iv
FOREWORD .....	vi
TABLE OF CONTENTS .....	vii
LIST OF FIGURES.....	x
LIST OF TABLES .....	xii
ABSTRACT .....	xiii
ABSTRAK .....	xiv
CHAPTER I INTRODUCTION .....	1
1.1 Research Background.....	1
1.2 Research Problem.....	2
1.3 Research Scope .....	3
1.4 Research Objectives .....	3
1.5 Research Benefit .....	3
1.6 Thesis Outline .....	3
CHAPTER II LITERATURE STUDY .....	5
CHAPTER III THEORETICAL BASIS.....	8
3.1 Microservice.....	8
3.2 GraphQL .....	9
3.2.1 Schema .....	12
3.2.2 Resolver.....	13
3.3 REST .....	14
3.4 Go-Life .....	14
3.5 Pre-Evaluate Go-Life .....	15
3.6 N+1 Problem .....	19
3.7 Performance Evaluation .....	21
3.7.1 Response Time .....	21
CHAPTER IV ANALYSIS AND DESIGN .....	22
4.1 System Analysis .....	22
4.1.1 System Overview .....	22
4.1.2 System Requirement Analysis .....	24
4.2 System Design.....	27
4.2.1. Architecture Analysis.....	28



4.2.1.1 Relational Data Request.....	28
4.2.1.2 Non-Relational Data Request.....	31
4.2.2 Server Implementation.....	32
4.2.2.1 Relational Data Request.....	33
4.2.2.2 Non-Relational Data Request.....	34
4.2.3 Client Implementation.....	35
4.3 System Testing.....	35
4.3.1 Relational Data Request Testing Scheme.....	37
4.3.1.1 REST Testing Scheme.....	37
4.3.1.2 GraphQL Testing Scheme.....	38
4.3.2 Non-Relational Data Request Testing Scheme.....	40
4.3.2.1 REST Testing Scheme.....	40
4.3.2.2 GraphQL Testing Scheme.....	41
4.4 Evaluation Analysis.....	42
CHAPTER V IMPLEMENTATION.....	44
5.1 Hardware and Software Specification.....	44
5.2 System Implementation.....	46
5.2.1 GraphQL Server Implementation.....	46
5.2.1.1 Relational Data Request.....	48
5.2.1.2 Non-Relational Data Request.....	51
5.2.2 Client Implementation.....	52
5.3 System Testing Implementation.....	54
CHAPTER VI RESULT AND DISCUSSION.....	55
6.1 Testing Overview.....	55
6.2 Functional Requirement Validation.....	55
6.3 Non-Functional Requirement Validation.....	56
6.4 Research Findings.....	58
6.4.1 N+1 Problem Solution.....	58
6.4.2 Relational Data Request Testing Result.....	60
6.4.3 Non-Relational Data Request Testing Result.....	60
6.4.3.1 Response Time Testing Result for 250 Rows of Data.....	61
6.4.3.2 Response Time Testing Result for 500 Rows of Data.....	62
6.4.3.3 Response Time Testing Result for 750 Rows of Data.....	62
6.4.3.4 Response Time Testing Result for 1000 Rows of Data.....	63
6.5 Hypothesis Evaluation.....	64



6.5.1 Relational Data Request Evaluation.....	64
6.5.2 Non-Relational Data Request Evaluation .....	64
CHAPTER VII CONCLUSION AND SUGGESTION.....	66
7.1 Conclusion.....	66
7.2 Suggestion .....	66
REFERENCES.....	67
ATTACHMENT .....	68